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NASA TECH BRIEF

Electrolytic Etching Process Provides Effective Bonding Surface on Stainless Steel

The problem:

To devise an etching process that will prepare surfaces of a 0.025-inch-thick 321 stainless steel shell for reliable, high strength adhesive bonding to dielectric materials. Inorganic halide acids or other halide compounds pose problems for use as etchants on stainless steel because they tend to induce stress corrosion cracking in this metal, and their rate of action is too rapid when the depth of etch has to be limited, as in this instance, to a maximum of 50 microinches. Another requirement is that discoloration of areas of highly polished stainless steel surfaces adjacent to the bond area be minimized.

The solution:

An electrolytic etching process employing a 25 percent aqueous solution of phosphoric acid.

How it's done:

A precut piece of filter paper is soaked in the etchant solution and placed upon the stainless steel area to be etched. A piece of 5052-S aluminum alloy mesh is then placed on the saturated filter paper. Terminals from a dc source are connected to the stainless steel and the aluminum mesh, with the stainless steel as anode and the aluminum as cathode. A current density of 5 to 18 amperes per square foot at 8 to 12 volts produces a localized, dull, frosty etch that provides an excellent surface for adhesive bonding. The time required for etching will vary from 5 minutes to 2 hours, depending on the area treated. This slow etching rate will minimize discoloration of adjacent areas and limit the depth of etch to a maximum of 50 microinches.

Notes:

1. Possible contamination of the etchant with phosphates is not considered detrimental. Residual amounts of this etchant on the bond areas are much less corrosive than halide etchants.
2. Samples of dielectric material adhesively bonded to stainless steel surfaces prepared by this method remained adherent after being subjected to a series of severe vibration and thermal vacuum tests.
3. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10299

Patent status:

No patent action is contemplated by NASA.

Source: Radio Corporation of America,
Astro-Electronics Div.
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Category 03